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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/918,463	08/01/2001	Yongju Jung	1567.1014	2888
21171	7590	01/21/2005	EXAMINER	
STAAS & HALSEY LLP SUITE 700 1201 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			DOVE, TRACY MAE	
			ART UNIT	PAPER NUMBER
			1745	

DATE MAILED: 01/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/918,463

Applicant(s)

JUNG ET AL.

Examiner

Tracy Dove

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 November 2004.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-16, 19-26 and 32-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16, 19-26, 32-35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

This Office Action is in response to the communication filed on 11/10/04. Applicant's arguments have been considered, but are not persuasive. Claims 1-16, 19-26 and 32-35 are pending and remain rejected. This Action is made FINAL, as necessitated by amendment.

#### *Claim Rejections - 35 USC § 112*

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-16, 19-26 and 32-35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 1, 12, 19 and 33 recite "wherein the mixed organic solvent includes about 40% by volume of the weak polar solvent, the about 40% by volume representing less than 40% by weight of the weak polar solvent, wherein the weak polar solvent is a main solvent with respect to volume", which is not supported by the specification as filed. Only the specific volume ratios for the specific solvents used for the mixed organic solvent are supported by Table 1. Examiner points out that an example that provides a single volume or weight percentage does not provide support for "less than" the single volume or weight percentage disclosed by the example. Therefore, the examples do not provide support for at least the claim limitation "less than 40% by weight". Furthermore, the examples do not teach "about" or "approximately", but recite specific volume percentages for the solvents. Examiner points out that none of Examples

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2-7 teach “wherein the weak polar solvent is a main solvent with respect to volume” and

Example 1 teaches 60 volume percent of dimethoxyethane (weak polar solvent).

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-16, 19-26 and 32-35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 12, 19 and 33 recites “wherein the mixed organic solvent includes about 40% by volume of the weak polar solvent, the about 40% by volume representing less than 40% by weight of the weak polar solvent, wherein the weak polar solvent is a main solvent with respect to volume”, which is indefinite. It is not possible to determine the scope of the claim because the amount of each solvent in the mixed organic solvent cannot be determine. The claim recites both volume percentages and weight percentages, but does not recite the entire composition of the mixed organic solvent. One of skill cannot determine the weight percentage of the weak polar solvent when provided with the volume percentage of the weak polar solvent without knowing the volume percentage of each organic solvent contained in the mixed organic solvent.

Furthermore, claims 1, 12, 19 and 33 recite “the about 40% by volume representing less than 40% by weight of the weak polar solvent”. However, the 40% by volume represents all of the weak polar solvent contained in the mixed solvent. Thus, the 40% by volume represents 100% by weight of the weak polar solvent. The claims do not recite that 40% by volume of the weak polar solvent represents less than 40% by weight based on the total weight percent of the mixed organic solvent.

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To the extent that the claims are understood in view of the 35 U.S.C. 112 rejections above, note the following prior art rejections.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-16, 19-26, 32 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al., US 6,030,720.

Chu teaches electrolyte solvents for lithium-sulfur batteries. The disclosed solvents include at least one ethoxy repeating unit compound solvent such as a glyme. The solvent may further include a donor solvent and/or an acceptor solvent. The donor solvent may be hexamethylphosphoramide, dimethylsulfoxide, dimethylacetamide or dimethylformamide. The solvents assist in solvation of lithium ions, sulfide and polysulfide anions. See abstract. Claim 5 recites the main solvent is tetraglyme (weak polar solvent of instant claim 5). Claim 8 recites the donor solvent may be at least one of hexamethylphosphoramide, dimethylsulfoxide, dimethylacetamide or dimethylformamide (strong polar solvent of instant claim 6). It should be understood that the electrolyte solvents of this invention may also include other cosolvents which do not necessarily fall into the donor solvent and acceptor solvent classes. Examples of such additional co-solvents include sulfolane (strong polar), tetrahydrofuran (lithium protection solvent of claim 7), dioxolane (lithium protection solvent of claim 7), dialkyl carbonates (weak polar), propylene carbonate (strong polar), ethylene carbonate (strong polar), dimethyl

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carbonate, diethyl carbonate, butyrolactone (strong polar), dimethoxyethane (weak polar) and combinations of such liquids (col. 14, lines 33-41). Thus, Chu teaches a mixed solvent comprising a weak polar solvent, a strong polar solvent and a lithium protection solvent, as defined by the presently claimed invention. Chu teaches the liquid electrolyte solvent includes “about 50 to 100% by weight of the main solvent (weak polar solvent(s)), excluding salts (14:42-55). The positive electrode includes a sulfur-based material such as elemental sulfur and the negative electrode includes lithium metal (col. 5, line 55-col. 6, line 21). The positive electrode may include an electrically conductive material (col. 8, lines 35-42). The electrolyte may include an electrolyte salt such as lithium trifluoromethanesulfonimide (sulfur-containing) (col. 14, lines 56-67). The protection layer 8 is formed on the negative electrode (Fig. 1 and 2B).

Regarding claims 8-10 and 13-15, Chu teaches that the negative electrode may comprise any metal and polyether electrolytes are known to transport divalent ions such as zinc (col. 20, lines 40-50). The materials for the negative electrode include a lithium alloy. Preferred alloys include lithium aluminum, lithium silicon (Si) and lithium tin alloys. Other metallic electrodes may include aluminum (Al), zinc (Zn), lead (Pb) and their alloys (col. 21, lines 1-9). The positive electrode may include sulfides or polysulfides or the metal or metals found in the negative electrode (col. 5, lines 55-65). The positive electrode may include metal sulfide additives (col. 16, lines 39-65).

Regarding claims 19 and 20, identical solvents will have the same ability to dissolve polysulfides, elemental sulfur and/or lithium polysulfide.

Regarding claims 21 and 22, identical solvents will have the same dielectric coefficients. Chu teaches that a desirable property of both donor and acceptor co-solvents used is a high

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dielectric constant. Such solvents generally promote dissociation of an ionic solute or a contact ion-pair (col. 14, lines 1-5).

Regarding claim 33, Example 1 teaches elemental sulfur, carbon black and polyethylene oxide in a solution of acetonitrile were mixed to form a slurry. The slurry was applied to a current collector to form the positive electrode. Figure 1 shows a lithium/liquid electrolyte/sulfur cell 10 having a positive electrode 18 with positive collector 20, a negative electrode 14 with negative collector 12, a separator 16 and a protective layer 8.

Chu does not explicitly teach the mixed organic solvent includes about 40% by volume of the weak polar solvent, the about 40% by volume representing less than 40% by weight of the weak polar solvent, wherein the weak polar solvent is a main solvent with respect to volume.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because the courts have ruled where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412. The courts have held that a limitation merely with respect to proportions in a composition of matter or process will not support patentability unless such limitation is “critical”. Minerals Separation, Ltd. v. Hyde, 242 U.S. 261 (1916). Chu teaches the liquid electrolyte solvent includes “about 50 to 100% by weight of the main solvent (weak polar solvent(s)), excluding salts (14:42-55). The disclosure of “about 50%” includes values slightly below “50%”, thus the claim limitation “about 40 volume percent” is considered obvious absent a showing of criticality.

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Furthermore, claims that differ from the prior art only by slightly different (non-overlapping) ranges are prima facie obvious without a showing that the claimed range achieves unexpected results relative to the prior art. See *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685 (Fed. Cir. 1996) Claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. Applicant's own data in Table 1 on page 10 of the specification shows the first listed "Example 1" and "Example 2" results in the same discharging current density and sulfur utilization. Thus, there is no "unexpected result" when using 40 vol% of dimethoxyethane (weak polar solvent) versus 60 vol% of dimethoxyethane.

Note this imitation has been rejected as containing new matter.

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Claims 1-16, 19-26, 32 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nimon et al., US 6,225,002.

Nimon discloses dioxolane as a protector for lithium (negative) electrodes of lithium-sulfur batteries (title). Battery cells containing dioxolane as an electrolyte co-solvent exhibit improved cycling performance over cells not containing dioxolane (abstract). Figure 9 shows a mixed solvent of tetraglyme (weak polar solvent) and dioxolane (lithium protection solvent). The electrolyte includes a main solvent having the chemical formula shown in col. 3, line 18 and a co-solvent wherein the co-solvent includes dioxolane. The electrolyte may also include an additional co-solvent having a donor number of at least about 13 (col. 3, lines 15-25). The battery includes a sulfur-based positive electrode. Donor solvents (strong polar solvents) are



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disclosed in col. 7, lines 14-22. The electrolyte may include other co-solvents such as those listed on col. 7, lines 32-41. The lithium salts of the electrolyte are listed in col. 7, lines 42-46.

Note Chu et al., US 6,030,720 is incorporated by reference in Nimon (col. 6, lines 26-29). See discussion of Chu above regarding claims 1-16, 19-26, 32 and 33.

Nimon does not explicitly teach the mixed organic solvent includes about 40% by volume of the weak polar solvent, the about 40% by volume representing less than 40% by weight of the weak polar solvent, wherein the weak polar solvent is a main solvent with respect to volume.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because the courts have ruled where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412. The courts have held that a limitation merely with respect to proportions in a composition of matter or process will not support patentability unless such limitation is “critical”. Minerals Separation, Ltd. v. Hyde, 242 U.S. 261 (1916). Nimon teaches the liquid electrolyte solvent includes “about 50 to 100% by weight of the main solvent (weak polar solvent(s)), excluding salts (14:42-55). The disclosure of “about 50%” includes values slightly below “50%”, thus the claim limitation “about 40 volume percent” is considered obvious absent a showing of criticality.

Furthermore, claims that differ from the prior art only by slightly different (non-overlapping) ranges are prima facie obvious without a showing that the claimed range achieves unexpected results relative to the prior art. See In re Woodruff, 16 USPQ2d 1935, 1937 (Fed.

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Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685 (Fed. Cir. 1996) Claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. Applicant's own data in Table 1 on page 10 of the specification shows the first listed "Example 1" and "Example 2" results in the same discharging current density and sulfur utilization. Thus, there is no "unexpected result" when using 40 vol% of dimethoxyethane (weak polar solvent) versus 60 vol% of dimethoxyethane.

Note this imitation has been rejected as containing new matter.

»

Claims 1-16, 19-26 and 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Katz et al., US 6,358,643.

Katz teaches a liquid electrolyte lithium-sulfur battery. It is generally desirable that the positive electrode have a relatively high porosity, possibly as high as 95% or more. Generally, higher porosity electrodes allow fabrication of cells with higher laminate energy densities because less electronic conductor is required. Of course, an electrode's porosity, capacity and thickness are linked so that setting two of these parameters fixes the other.

Note Chu et al., US 6,030,720 is incorporated by reference in Katz (col. 1, lines 21-22). See discussion of Chu above regarding claims 1-16, 19-26, 32 and 33.

Katz does not explicitly teach the mixed organic solvent includes about 40% by volume of the weak polar solvent, the about 40% by volume representing less than 40% by weight of the weak polar solvent, wherein the weak polar solvent is a main solvent with respect to volume.

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However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because the courts have ruled where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412. The courts have held that a limitation merely with respect to proportions in a composition of matter or process will not support patentability unless such limitation is “critical”. Minerals Separation, Ltd. v. Hyde, 242 U.S. 261 (1916). Katz teaches the liquid electrolyte solvent includes “about 50 to 100% by weight of the main solvent (weak polar solvent(s)), excluding salts (14:42-55). The disclosure of “about 50%” includes values slightly below “50%”, thus the claim limitation “about 40 volume percent” is considered obvious absent a showing of criticality.

Furthermore, claims that differ from the prior art only by slightly different (non-overlapping) ranges are prima facie obvious without a showing that the claimed range achieves unexpected results relative to the prior art. See In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685 (Fed. Cir. 1996) Claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. Applicant’s own data in Table 1 on page 10 of the specification shows the first listed “Example 1” and “Example 2” results in the same discharging current density and sulfur utilization. Thus, there is no “unexpected result” when using 40 vol% of dimethoxyethane (weak polar solvent”) versus 60 vol% of dimethoxyethane.

Note this imitation has been rejected as containing new matter.

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*Response to Arguments*

Applicant's arguments filed 11/10/04 have been fully considered but they are not persuasive.

35 U.S.C. 112, first paragraph

Applicant argues Examples 2-5 clearly recite embodiments wherein the mixed organic solvent includes about 40% by volume of the weak polar solvent, the about 40% by volume representing less than 40% by weight of the weak polar solvent, wherein the weak polar solvent is a main solvent with respect to volume (refers to Table 1). However, Table 1 teaches volume ratios (not weight percent ratios). Furthermore, only the specific volume ratios for the specific solvents used for the mixed organic solvent are supported by Table 1. Examiner points out that an example that provides a single volume or weight percentage does not provide support for "less than" the single volume or weight percentage disclosed by the example. Therefore, the examples do not provide support for at least the claim limitation "less than 40% by weight". Furthermore, the examples do not teach "about" or "approximately", but recite specific volume percentages for the solvents. Thus, the 35 U.S.C. 112, 1<sup>st</sup>, rejection is maintained.

35 U.S.C. 112, second paragraph

The amendment overcomes all previous 35 U.S.C. 112, 2<sup>nd</sup>, rejections. However, claims 1-16, 19-26 and 32-35 are newly rejected under 35 U.S.C. 112, second paragraph.

35 U.S.C. 102(e)

Applicant's arguments with respect to claims 1-16, 19-26 and 32-35, rejected under 35 U.S.C. 102(e) in view of Chu, Nimon or Katz, have been considered but are moot in view of the new ground(s) of rejection.

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***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tracy Dove whose telephone number is 571-272-1285. The examiner can normally be reached on Monday-Thursday (9:00-7:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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January 14, 2005